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## COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

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### TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled:

EAR PLUG.

The following statement is a full description of this invention, including the best method of performing it known to me:—

\*Note: The description is to be typed in double spacing, pica type face, in an area not exceeding 250 mm in depth and 160 mm in width, on tough white paper of good quality and it is to be inserted inside this form.

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# COMPLETE SPECIFICATION

(ORIGINAL)

Class

Int. Class

Application Number:

Lodged:

Complete Specification Lodged:

Accepted:

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Related Art:

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### APPLICANT'S REF.:

Name(s) of Applicant(s): AUDIGENE ACoustics PTY. LTD.

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MR. MARCH'S FUSED PLATE TAPER

24 MAY 1981

PATENT OFFICE

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Complete Specification for the invention entitled:

"EAT EFFECTIVE DEVICE"

The following statement is a full description of this invention, including the best method of performing it known to applicant(s):

This invention relates to apparatus for protecting the ears of persons and is particularly relevant to ear muffs and ear plugs for example.

10 Ear muffs and plugs are used quite commonly to reduce the intensity of sound incident upon the ear drum. Ear plugs commonly used range from cotton wool for like pads to a special molded plug adapted to the shape of a particular persons ear. Difficulties are experienced however in the removal of the ear plugs and re-insertion which of course is necessary when a person desires to hear a particular sound but not others. Such ear plugs provide little or no control over the extent of the sound reduction and tend to build up pressure within the ear when inserted.

20 It has been proposed previously to insert a diaphragm into the outer ear to reduce the effect of shock sound waves but to enable sound waves of normal intensity frequency to reach the ear drum so that the wearer may maintain normal hearing whilst being protected from shock sound waves. But again it is difficult to control such diaphragms.

Similarly ear muffs have been used but it is difficult for wearers to hear a wanted sound unless the muffs are removed from the ears. This is most usually inconvenient.

The object of the present invention is to provide an apparatus that is capable of protecting the ears of persons, and at the same time being readily adjustable as desired to open and close the ear to sound waves.

----- The present invention provides an ear protective device that includes a sound insulative body portion capable of extending over and/or within the ear of persons, a sound passageway extending through the body portion from the outside thereof to provide for transmission of soundwaves to the ear cavity and valve means for the passageway moveable between a valve open position to provide its minimum obstruction to sound waves passing to the ear cavity and a valve closed position whereby to provide its maximum obstruction to such sound waves.

10 The device may be in the form of an ear plug having a body portion adapted to extend within the ear cavity and a passageway that extends substantially axially through the body. Alternatively the device may be in the form of an ear muff where the body provides a shell adapted to extend over the ear of the person and where the passageway is provided by an opening through the outer wall thereof.

20 The above features will now be described with reference to several preferred arrangements of the invention. It will be appreciated that details of the construction that follow should not be taken as restrictive upon the present invention except as where previously clearly indicated. In the drawings:

Figure 1 shows in partial cross-section of an ear plug including one form of valve means;

Figure 2 is an ear plug including an alternative valve means;

30 Figure 3 is a partial cross-section of an ear

muff including a butterfly valve and;  
Each of Figures 4, 5, 6, 7, and 8 show  
alternative forms of valve means suitable for  
use in connection with use of the devices of  
the present invention shown herein in relation  
to an ear muff.

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The ear protective device includes a sound  
insulative body portion which is capable of extending  
over and/or within the ear of a person. Figures 1 and  
2 illustrate an ear plug for which the body portion 11  
is formed to the shape of an ear cavity so that it may  
be conveniently inserted therein. It will be appreciated  
that the shape of the body 11 may be designed by  
moulding to suit a particular person. Alternatively  
standard shapes adapted to suit a variety of persons  
may be employed and is well known in the art. The body  
11 may be made suitably from acrylic resins, silicone  
rubber or other plastic materials as desired and may  
be solid, hollow or of any suitable formation.

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A sound passageway 12 extends through the body  
11 to provide for transmission of sound waves from the  
outside of the plug to the ear cavity. The sound  
passageway 12 may be of any suitable shape and follow  
any suitable path but it is preferred that it extend  
substantially axially of the body 11. It will be  
appreciated that the body 11 when moulded to suit the  
ear will be of a particular somewhat convoluted form  
as best shown in Figure 1 and that the preferred sound  
passageway 12 will conform generally to this shape so  
that it is maintained generally centrally within the

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body 11 for the purpose of strength. The sound passageway is preferably such as to convey from the outside of the plug to the ear cavity sounds of frequency and intensity that will permit the wearer to achieve a normal hearing function. However in some uses it may be desired that the passageway be somewhat restricted whereby to limit the intensity of sound admitted to the inside of the ear. In addition a plug or sound absorbing material may be located in the passageway if desired.

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In an alternative form of the invention the device is provided by an ear muff as illustrated in the embodiment shown in Figures 3 to 6. The preferred ear muff includes an outer shell 13 providing the body of the device. The outer shell may be of any suitable material such as metal or moulded plastics for example. A sound insulative liner portion 14 is preferably provided within the shell 13. The liner portion may be of any suitable sound insulative material such as a foamed polymer for example and preferably includes a cushioning rim 16 adapted to provide a comfortable but relatively sound proof seal for the outer shell upon the wearer's head. It will be appreciated that any known ear muff may be employed for the purposes described to this stage. Preferably however, a tube member 17 is provided of similar material to the liner portion 14 to define therein an elongated passageway 18.

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The device of the present invention also includes valve means for the passageway. The valve means is moveable between a valve open position to provide its

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minimum obstruction to sound waves passing to the air cavity and a valve closed position whereby to provide its maximum obstruction to such sound waves. Preferably the valve means is also operable to move into several prearranged intermediate positions within the passageway which will then be partly closed thereby.

The valve means may be provided in any one of many suitable alternative constructions. Several of these are illustrated in the accompanying drawings. The valve means may include for instance a valve cover member 21 adapted to extend over the outer end of the passageway 12 or 18 when in its valve closed position and being moveable into a valve open position separated from the opening of the passageway. For example the cover member 21 may be moveable between its open and closed positions axially with respect to the longitudinal axis of the passageway. Such an arrangement is shown in Figure 1 where the cover member 21 includes a resilient portion 22 slidably mounted within the passageway 12 whereby to tie the cover member to the body. The resilient portion 22 may include resilient legs 23 including barbs 24 which hold the cover member 21 within the valve body by abutment with annular member 26 located within the outer end of the passageway 12. It will be appreciated that the cover member 21 may be inserted within the end of the passageway 12 by depressing the resilient legs 23 inwardly. Once the barbs 24 have passed the edge of the annular member 26 the cover member 21 is held slidably mounted within the end of the passageway 12. In its

closed position as shown in Figure 1 the cover member 21 covers the passageway 12 to inhibit the passage of sound waves thereto. The passageway may be opened by gripping the cover member 21 with the fingers.

In an alternative form shown in Figure 2 a tapered valve plug 27 is provided to fit within the outer end of the passageway 12. A retaining member such as a retaining wire 28 may be provided between the plug 27 and the body 11. An annular member 26 may be provided as before. The plug as shown in Figure 2 is in its closed position and it will be appreciated that the top of it may be grasped with the fingers to enable the plug to be pulled from the end of the passageway 12 to allow ingress of sound waves thereto. The plug is retained in the vicinity of the ear plug because of the member 28 and its abutment against the annular member 26.

The ear plugs of Figures 1 and 2 may be provided in pairs as desired and may be joined together by a head band passing over the head of the wearer should this be desired.

In the arrangement shown in Figure 3 the valve means includes a butterfly valve mounted within the passageway 12 and operable by a valve lever 31 to move between its valve open and valve closed positions. In Figure 3 the butterfly valve is shown in its open position. The broken lines indicate the position of the butterfly valve in its closed position. Preferably the butterfly valve includes a valve member 32 pivotally mounted within the passageway 12 preferably

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by pivot 33. The butterfly valve is preferably located within a flexible sleeve 30 in annular member 26. The valve member 32 preferably conforms in shape to the cross-section of the member 26 but any variation is accommodated by the sleeve 30. Thus in its position shown the broken lines effectively extends across the entire cross-section of the passageway 18. On the other hand movement of the lever 31 may pivot the valve into its open position to allow sound waves to pass through the passageway 18.

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In the arrangement shown in Figure 4 a valve cover member 34 is provided that is connected to the body by a screw thread. To this end a screw threaded pin 36 may extend into a screw threaded member 37 within the passageway 18. Preferably a gnarled finger gripping portion 38 is provided around the edge of the cover member 34 so that it may be easily grasped with the fingers and an annular sealing rim 39 maybe provided to abut against the annular member 26 when the valve member is in its closed position.

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In Figure 4 the valve member is shown in its open position.

In the arrangement shown in Figure 5 the valve cover member 41 is hingeably mounted to the body. To this end the valve cover member 41 maybe pivotally mounted to stand member 42. A lever extension 43 maybe provided for hinging of the valve cover member. A clip 44 maybe provided to hold the cover member in its open position if desired.

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In the alternative form of the invention as

10      illustrated in Figure 6 the valve means includes a fixed cover member 46 extending over the outer opening of the passageway 18. The fixed cover member 46 has one or more access holes 47 therethrough. A rotatable cover member 48 is mounted over the fixed cover 46. The rotatable cover member 48 includes one or more access openings 49. It will be appreciated that the rotatable cover member 48 may be rotated so that the access openings 49 are adjacent the access holes 46 to enable sound waves to pass through to the passageway 18.

20      In the arrangement shown in Figure 7 an annular valve insert 51 is provided including a grill 52 or the like through which may pass an operating lever 53. The grill 52 inhibits entry of dust and dirt to the passageway. A valve member 54 is provided within the passageway 18 and it will be seen that the lever 53 may be pulled by the fingers to close the valve member 54 against the annular valve insert 51 to seal the passageway 18 against ingress of sound waves. At this point a recess 56 may clip into the grill 52 to hold the valve in its closed position. Pressure of the finger against the lever 53 will move the valve member downwardly into its valve open position.

30      In the arrangement shown in Figure 8 a valve cover member 57 is provided slideably mounted in a trackway 58 extending substantially perpendicularly to the axis of the passageway 18. A finger gripping portion 59 may be provided so that the cover member 57 may be slid between a valve closed position over the end of passageway 18 and a valve open position. In

Figure 8 the cover member 57 is shown in an intermediate position.

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It will be appreciated that many minor alterations and variations may be made to the arrangement of valve means as previously described. In one example a sound detecting means such as a microphone may be provided together with a valve control circuit preferably including a signal amplifier. The control circuit may include an electromagnet or the like to open and close the valve means automatically in response to the intensity of sound incident upon the sound detecting means.

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Where the device is in the form of ear muffs as shown in Figures 3 to 8 it is preferred that a pair be provided joined by a head band. It is preferred to provide the tube member 17 in the case of ear muffs to avoid substantially the possibility of resonance within the ear muff itself. The lower end of the tube member 17 is preferably arranged to be located immediately adjacent the ear cavity of the wearer.

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It will be seen that the devices of the present invention may be worn by persons when they are in a noisy environment. When it is desired to hear particular sounds such as when it is desired to talk on the telephone or to have a discussion with a fellow worker for example one may quickly and readily operate the valve means to improve hearing capability for the duration of the conversation. Thereafter the valve means may be moved into its closed position to again protect the ear from the noise. It will be seen then that the

present invention provides a simple and easily operated ear protective device that can be used to control the sounds admitted to the ear. At the same time the invention provides in an alternative form for remote control and automatic control of the intensity of sound admitted to the ear.

It will be appreciated that various minor alterations and modifications may be made to the above described arrangements and construction of parts without departing from the ambit of the invention as defined in the claims annexed hereto.

The Claims Defining the Invention are as follows:

1. An ear protective device including a sound insulative body portion capable of extending over and/or within the ear of a person, a sound passageway extending through said body portion from the outside of the body to provide for transmission of sound waves to the ear cavity and valve means for said passageway movable between a valve open position to provide its minimum obstruction to sound waves passing to the ear cavity and a valve closed position whereby to provide its maximum obstruction to such sound waves.
- 10 2. In ear protective device as claimed in claim 1, wherein said valve means includes a tapered valve plug adapted to fit within the outer end of said passageway whereby to close said passageway.
3. In ear protective device as claimed in claim 2, wherein a retarding member is provided between said plug and said body whereby when said plug is removed from the end of said passageway into a valve open position it is held in close proximity ready for further use.
- 20 4. An ear protective device as claimed in claim 1, wherein said valve means includes a valve cover member adapted to extend over the outer end of said passageway when in its valve closed position and being movable into a valve open position separated from the opening of said passageway.
5. An ear protective device as claimed in claim 4 wherein said cover member is movable between its valve

open and valve closed positions axially with respect to the longitudinal access of said passageway.

6. An ear protective device as claimed in claim 5, wherein said cover member includes a resilient portion slidably mounted within said passageway whereby to tie said cover member to said body.

7. An ear protective device as claimed in claim 5, wherein said cover member is screw threadedly attached to said body.

10 8. An ear protective device as claimed in claim 5, wherein said cover member is hingedly mounted to said body.

9. An ear protective device as claimed in claim 4, wherein said cover member is slidably mounted to said body in a track; extending substantially perpendicularly to the axis of said passageway.

10. An ear protective device as claimed in claim 4, wherein said valve means includes a fixed cover member extending over the outer opening of said passageway, said fixed cover member having one or more access holes therethrough and wherein said valve means includes a rotatable cover member mounted over said fixed cover, said rotatable cover member including one or more access openings adapted to correspond with said access holes when said valve means is in its valve open position, but not when said valve means is in its valve closed position.

11. An ear protective device as claimed in claim 4, wherein said valve means includes a butterfly valve mounted within the passageway and operable by a valve

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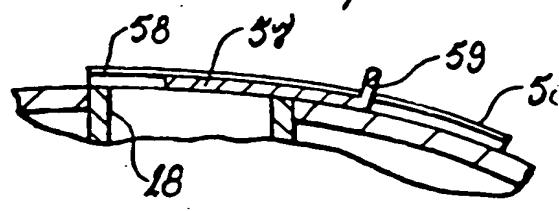
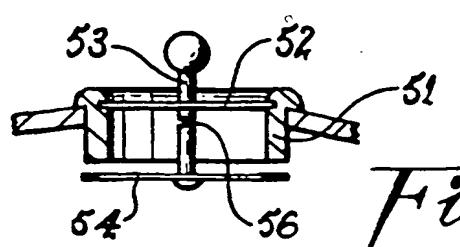
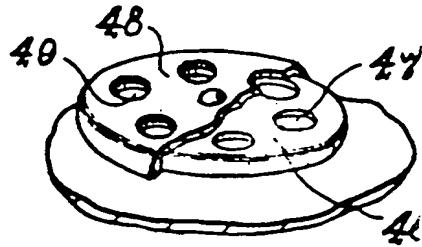
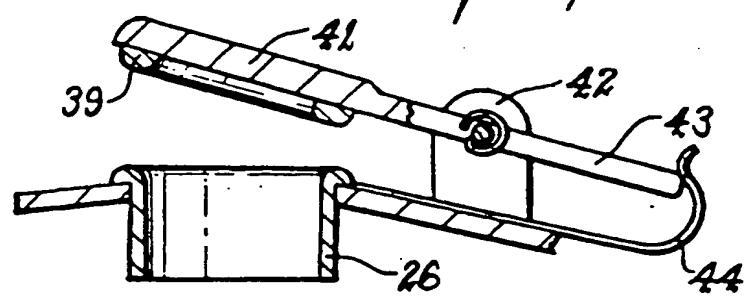
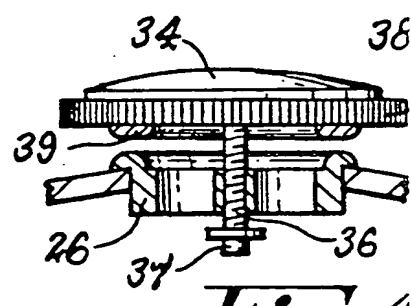
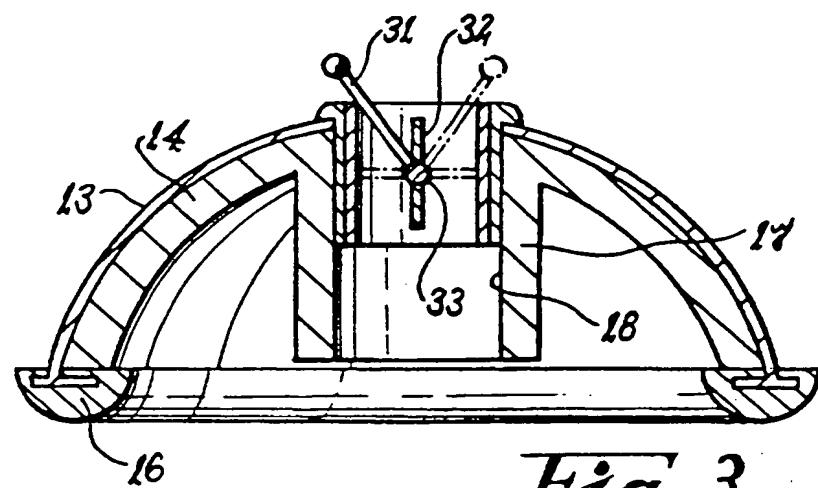
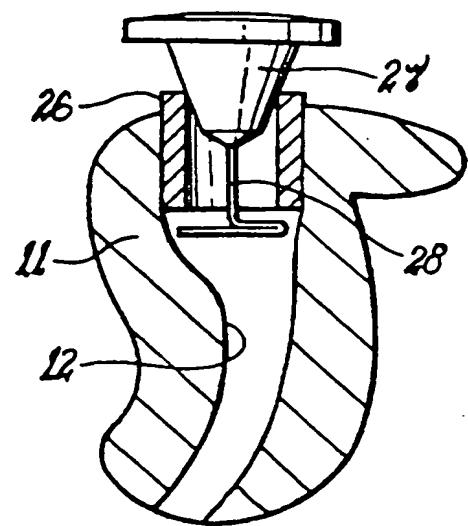
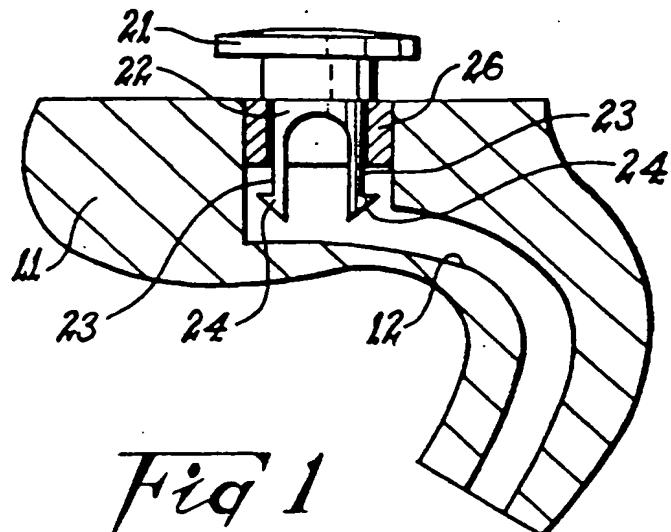
- lever extending from the outer end of said passageway.
12. An ear protective device as claimed in any preceding claim, wherein said body portion is adapted to extend within the ear cavity and said passageway is an elongated passageway extending substantially axially through said body portion, whereby to provide an ear plug.
13. An ear protective device as claimed in claim 12, including a pair of said ear plugs joined by a head band member.
- 10 14. An ear protective device as claimed in any one of claims 1 to 11, wherein said body is in the form of a shell adapted to extend over the ear of a person and wherein said passageway is provided by an opening through the outer wall thereof, whereby to provide an ear muff.
15. An ear protective device as claimed in claim 14, including a tube member providing an elongated passageway extending from the opening in said shell wall to the vicinity of the ear cavity.
- 20 16. An ear protective device as claimed in claim 14 or claim 15, including a pair of said ear muffs joined by a head band.
17. An ear protective device as claimed in any preceding claim including sound detecting means and a valve control circuit adapted to open and close said valve means automatically in response to the intensity of sound incident on said sound detecting means.

18. An ear protective device as claimed in claim  
1 substantially as hereinbefore described with reference  
to the accompanying drawings.

DATE: 25rd. May, 1973

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